



## PHENIX DC/PC Gas System in the PEH

### PHENIX Procedure No. PP-2.5.2.4-04

Revision: B

Date: 6/4/2013

HPC No.


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Page Nos.

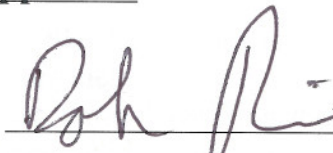
Initials

- *Typo: Section 5, it makes reference to Attachment 6. There is an attachment, but the title "Attachment 6" is missing*
- *Typo: Reference and Attachment sections are missing*
- *Typo: Items in section 5 should be labeled as 5.1, 5.2, etc. (instead of 1, 2, etc.)*

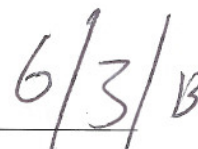
#### Approvals



PHENIX S E & I      Date



Cognizant Scientist



Date



PHENIX Safety      Date

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### **Approvals**

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PHENIX S E & I      Date

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Cognizant Scientist      Date

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PHENIX Safety      Date

**REVISION CONTROL SHEET**

<b>LETTER</b>	<b>DESCRIPTION</b>	<b>DATE</b>	<b>WRITTEN BY</b>	<b>APPROVED BY</b>	<b>CURRENT OVERSIGHT</b>
A	First Issue	6/24/2010	R. Pisani	R. Pisani, P. Giannotti, D. Lynch	R. Pisani
B	3 year review with no changes to content. New rev letter and date	6/4/2013	R. Pisani	R. Pisani, P. Giannotti, D. Lynch	R. Pisani

## **1. Purpose**

The purpose of this document is to define the local emergency plan for operation of the Gas Systems for the PHENIX Pad and Drift Chambers.

This procedure contains the steps necessary to start the DC/PC gas system from a fully shutdown state and to purge the chambers.

In addition to the Operating Procedures this document specifies the Local Emergency Plan of the HBD. This Local Emergency Plan will ensure:

- 1.1 the safety of all personnel from risks associated with the operation of the gas system required for running the Pad and Drift Chambers
- 1.2 the implementation of the appropriate emergency procedures,
- 1.3 prompt notification of the appropriate C-A and S&EP specialists,
- 1.4 the maintenance of appropriate C-A emergency status,
- 1.5 the preservation and protection of the environment, and
- 1.6 the preservation of BNL facilities and equipment, and

## **2. Responsibilities**

During PHENIX operations, there will be two levels of responsibility for the oversight of the gas system: the PHENIX shift crew and the PHENIX GAS experts.

The first level of responsibility resides with the PHENIX Shift Crew. During any period when the DC/PC has flammable gas flowing or HV on, there will be a minimum of two people on continuous shift in the PHENIX counting house. Once data taking starts, the number of people on shift at PHENIX will increase to five. The second level of responsibility resides with the PHENIX gas experts. The gas experts will be on-call to respond to any alarm or unusual occurrence detected by the PHENIX shift crew. A record of the performance of the DC/PC gas system will be maintained and monitored by the gas system experts and shift crew.

During watch shifts or data taking, it will be the responsibility of the PHENIX Shift Crew to:

**2.1 Monitor the status and alarms for the gas system.**

**2.2 In the event of an alarm or unusual occurrence, contact an expert from the Expert Call List.**

The second level of responsibility is the gas experts. It is the responsibility of the Gas experts to:

**2.3 Maintain the DC/PC Gas System in a safe operating condition. This includes:**

- 2.3.1 Changing gas cylinders and dewars when required
- 2.3.2 Setting, adjusting, and checking the gas mixture, flow rates and pressures.
- 2.3.3 Checking the certification of the operating gas (see details in Precautions, Section 4)
- 2.3.4 Posting any special instructions or notifications as required
- 2.3.5 Carrying out any emergency actions, as prescribed in the Procedures section of this document.

See Attachment 2 for additional information

**3.0 Prerequisites**

The Gas Expert shall have read or have training in the following areas:

- 3.1 PHENIX Local Emergency Plan, RHIC-OPM 3.16,
- 3.2 BNL Compressed Gas Safety Training Course,
- 3.3 BNL Electrical Safety I
- 3.4 RHIC/PHENIX access training
- 3.5 BNL Haz-com
- 3.6 BNL General Employee Training

**4.0 Precautions**

#### 4.1 Gas System Precautions:

- 4.1.1 All gas cylinder storage is on the PHENIX Gas pad located just south and east of Building 1008 F, the PHENIX Gas Mixing Hut. All gas cylinders and dewars are to be changed by **authorized** PHENIX personnel with current BNL Compressed Gas Safety Training.
- 4.1.2 All valves and controls associated with the TOF.W Gas system are to be operated ONLY by **authorized** gas system experts with current training.
- 4.1.3 Primary care should be given to monitoring the internal pressure of the TOF.W throughout the duration of the start-up procedure, especially when adjusting flow rates. Over-pressurization of the TOF.W (above 3" WC) can result in structural damage to the detector.
- 4.1.4 **Before any HV can be turned on, sufficient operating gas must have flowed through each of the detectors for 4 volume exchanges.**
- 4.1.5 Any reconfiguration or adjustment to the Gas System in the PHENIX IR or mixing house is to be performed ONLY by an **authorized** Gas System expert with current training.
- 4.1.6 **NOTE: Over pressurization of the DC/PC (above 0.5"WC) will result in severe structural damage. Primary care should be given to monitoring the internal pressure of the detectors throughout the duration of this procedure, especially when adjusting flow rates.**

## 5 Standard Operating Procedures

These Procedures shall be carried out by Gas System Experts only.

The Gas system for the PC/DC is composed of a number of components.

- 1. Argon cylinders and cryogenic dewar located on the PHENIX Gas Pad, with regulators, evaporators, control and relief valves
- 2. Ethane cylinders located on the PHENIX Gas Pad, with regulators, control valves and relief valves
- 3. Argon and Ethane distribution manifolds located in the PHENIX Mixing House 1008F
- 4. DC/PC Gas rack located in the Gas room in 1008F
- 5. DC/PC Electronics Rack located in the Electronics room of 1008F
- 6. TEC/DC/PC carriage gas rack located underneath the East Carriage in the PHENIX IR.
- 7. DC/PC carriage gas rack located underneath the West Carriage in the PHENIX IR.

8. PC-1 supply manifold with control valves mounted in the base of the East and West Carriage.
9. PC-1 return manifold with flowmeters mounted in the base of the East and West Carriage.
10. PC-3 supply and return manifolds with control valves and -flowmeters mounted in the base of the East Carriage.
11. Normal venting to the PHENIX Mixing House Vent Stack
12. Emergency Venting to the PHENIX Low Capacity Vent Stack.

For details of the DC/PC Gas System schematics, please refer to Attachment 6. The labels of valves and meters in the operation instructions below refer to parts identified in the figures in Attachment 6.

#### 6.1 *Gas System Procedures*

Before flowing flammable gas to the Chambers, or any other PHENIX subsystem, call the Main Control Room (MCR) and notify them that flammable gas is being introduced to the IR. MCR shall also be notified before the flammable gas is purged from any PHENIX subsystem.

The Procedures describe starting gas flowing to the DC/PC after a long shutdown. They assume no gas is currently flowing, no flowmeters are adjusted and the PHENIX IR is open. If the PHENIX IR is closed it is necessary that the DC/PC carriage rack and flow meters must have been previously adjusted prior to any gas flow. If no gas has been flowing in the PC for 24 hours one must start flowing inert gas first.

##### 6.1.1 Power on the DC/PC Electronics Rack (Note: If system is powered on, go to step 6.1.2)

- 6.1.1.1 Turn on AC power for Electronic Rack (Receptacles Breaker)
- 6.1.1.2 Turn on mass flow controller power supplies (Electronic Rack)
- 6.1.1.3 Turn on Keithley Digital Multimeter and High Density Switch System
- 6.1.1.4 Turn on Alarm/Interlock box
- 6.1.1.5 Turn on and boot the gas system PC.
- 6.1.1.6 Start the gas system control program.
- 6.1.1.7 Turn on Power Supplies Breaker
- 6.1.1.8 Turn on AC power for Gas Rack

##### 6.1.2 Verify that Argon is flowing to the chambers at 3 LPM.

##### 6.1.3 Verify that the manual valve MV-E10 on the Ethane Distribution Panel in the Mixing House is closed.

##### 6.1.4 Open the six valves on top of the Ethane cylinder six-pack on the Gas Pad.

##### 6.1.5 Open the valve MV-E1A allowing Ethane to flow from the cylinders to fill the manifold.

##### 6.1.6 If more than one six-pack is being used, repeat steps 6.1.3 and 6.1.4 for all six-packs.

##### 6.1.7 Open valves MV-E2A, MV-E3A and MV-E4 to allow Ethane to flow to the regulator on the

Ethane manifold.













- 6.1.8 Adjust the output pressure of the regulator PR-E1 to 40 psig.
- 6.1.9 Open the valve MV-E8 to allow Ethane to flow into the pipes running to the Mixing House.
- 6.1.10 Verify that the manual valve outside the mixing house, MV-E9 is open.
- 6.1.11 Open MV-E10 on the Ethane Distribution Panel inside the MH.
- 6.1.12 Verify that the solenoid valve AV-E1 is powered and open.
- 6.1.13 Adjust the output pressure of the regulator PI-E3 to 20 psig.
- 6.1.14 Slowly open the relief valve MV-E13 and allow the Ethane Gas to flow through the piping to the MH, purging the line of oxygen. After the line is purged, (about 1 minute), close the relief valve again.
- 6.1.15 Open the valve MV-E11A to allow flow to the flow meter in the Ethane Distribution Panel.
- 6.1.16 Open the flow meter valve FM-E1A allowing flow to the DC/PC Gas Rack.
- 6.1.17 Verify that the solenoid valves SV16, SV18, SV20 and SV22 are open. These valves are in the IR, with control and monitoring on the DC/PC Gas Computer in the MH Computer Room. This allows gas to flow to the DC and/or PC.
- 6.1.18 Open the solenoid valve SV8 on the DC/PC Gas Rack by clicking on the SV8 icon on the DC/PC Gas Computer in the MH Computer Room.
- 6.1.19 Verify that the Mass Flow Controller FM1 is set to 10 SCFH.
- 6.1.20 Set the Mass Flow Controller FM2 to 10 SCFH on the computer. The Argon Gas Mass Flow Controller FM1 should be set already to 10 SCFH.
- 6.1.21 Adjust the output pressure of the regulator PCV-1 to 15 mBar.
- 6.1.22 Verify that the operating pressure reading of the pressure indicator PI-3 is 15 mBar.
- 6.1.23 Open MV-8 to allow flow through the Bypass Flow Meter FI2 on the DC/PC Gas Rack. This allows gas to escape from the DC/PC piping to the vent outside the MH. Allow the Ethane Gas to flow for several minutes to purge the piping of any oxygen in the pipes.
- 6.1.24 Close MV-8.
- 6.1.25 The Flow Meter for the East Arm Pad Chambers FI12 should be set already to 5 SCFH, and the valve MV9 should be closed. FI12 can be viewed on the video monitor in the CR.
- 6.1.26 Verify that the exhaust valve SV17 is open allowing Argon/Ethane Gas to flow back to the vent in the MH.
- 6.1.27 The Flow Meter for the West Arm Pad Chambers FI15 should be set already to 5 SCFH, and the valve MV15 should be closed. FI15 can be viewed on the video monitor in the CR.
- 6.1.28 Verify that the exhaust valve SV23 is open allowing Argon/Ethane Gas to flow back to the vent in the MH.
- 6.1.29 The Flow Meter for the East Drift Chambers FI13 should be set already to 14 SCFH, and the valve



MV11 should be closed. FI13 can be viewed on the video monitor in the CR.

- 6.1.30 Verify that the exhaust valve SV19 is open allowing Argon/Ethane Gas to flow back to the vent in the MH.
- 6.1.31 The Flow Meter for the West Drift Chambers FI14 should be set already to 14 SCFH, and the valve MV13 should be closed. FI14 can be viewed on the video monitor in the CR.
- 6.1.32 Verify that the exhaust valve SV21 is open allowing Argon/Ethane Gas to flow back to the vent in the MH.
- 6.1.33
- 6.1.34 Adjust the Mass Flow Controllers FM1 and FM2 to give a 50/50 mixture of Argon and Ethane Gas and sufficient flow through the Pad Chambers. At this point the Ethane Mass Flow Controller is slaved to the Argon Controller so that a 50/50 mixture is maintained. If the Ethane fraction should rise from 50 to 51%, a warning alarm is given to the gas monitor. A PHENIX shift person shall notify a PC Gas Expert of the discrepancy. If the Ethane fraction should rise as high as 52%, a serious alarm is raised and the Ethane flow is shut off. PHENIX Shift personnel shall notify a PC Gas Expert of this alarm condition.
- 6.1.35 Verify that the gas flow to each chamber is at 100 cc/min by checking the individual flowmeters locate on the gas manifolds under the East and West Carriages.
- 6.1.36 Record the time and date that gas flow was started for each chamber.
- 6.1.37 Allow the chamber to flow Mixed Gas until there has been at least three exchanges of gas inside the chamber. This represents about 24 hours for the Pad Chambers.
- 6.1.38 It is now safe to turn on the high voltage on the chamber.
- 6.2 *Gas System Procedures: In order to change a six-pack of gas cylinders:*
  - 6.2.1 Close the valve on the six-pack in use, either MV-E1A, MV-E1C, MV-E1E, MV-E1G, MV-E1J or MV-E1L.
  - 6.2.2 Open the valve to the full six-pack.
  - 6.2.3 Verify that the regulator is set to 40 psig.
  - 6.2.4 Record the starting cylinder pressure and the time and date in the gas logbook.
- 6.3 *Gas System Procedures: In order to shut off all flammable gas flow:*
  - 6.3.1 Close the Manual Valve MV-E10 on the Ethane Gas Distribution Panel.

# DC/PC Gas System

-  - Check Valve
-  - Manual Valve
-  - Solenoid Valve
-  - Pressure Safety Valve
-  - Pressure Transmitter
-  - Bubbler
-  - Pressure Control Valve
-  - Flow Mass Controller
-  - Flow Indicator
-  - Temperature Transmitter
-  - Pressure Indicator
-  - Flow Direction Indicator

